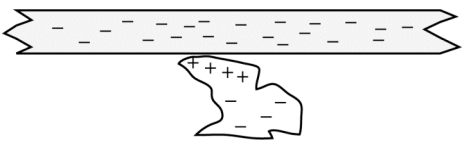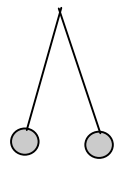# Assessment Schedule – 2008

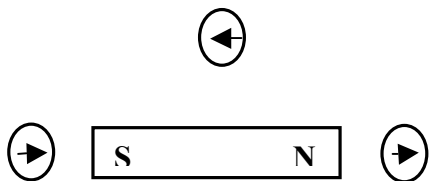# Physics: Demonstrate understanding of electricity and magnetism (90185)

## Evidence Statement

Note:  Minor computational errors will not be penalised. A wrong answer will be accepted as correct provided there is sufficient evidence that the mistake is not due to a lack of understanding. Such evidence includes:

- the last written step before the answer is given has no unexpanded brackets or terms and does not require rearranging.

- the power of any number that is multiplied by a power of 10 is correct.

| Q | Evidence | Achievement | Achievement with Merit | Achievement with Excellence |
|---|---|---|---|---|
| ONE (a) | Electrons (negative charges) can move through a conductor freely. Electrons (negative charges) cannot move through an insulator because they are tightly bound to the atom. | [1] Mentions that the conductor allows the electrons to move through easily while the insulator will not. | [1] Explanation given in terms of the bound or loose electrons / negative charges. | |
| (b) |  | [1] Correct distribution of charges. No + on plastic lid. (Ignore the number of charges.) | | |
| (c) | Negatively charged plastic induces (polarises) positive charges at the top end of the paper. Since opposite charges attract, the positively charged end of the paper is attracted to the negatively charged plastic and remains attached to it. | [1] Mentions that the paper and plastic have opposite charges so they attract. | [1] Correct full explanation. There must be no suggestion that the positive charges in the paper move.) | |
| (d) | The paper pieces fall back to the table. Plastic eventually loses negative charges to air and becomes neutral, so the paper pieces fall down. | [1] Mentions the paper pieces fall back to the table. No reference to repulsion. | [1] Correct description and explanation. | |
| (e) |  Some negative charges from the sphere are removed by the positively charged wool. Now both spheres become positively charged as some electrons transfer from left sphere to the right sphere through their metal coatings. Since same charges repel, the spheres repel each other. | [1] Correct diagram showing repulsion. OR asymmetrical diagram and mentions both spheres are **positively** charged so they repel. | [1] Mentions both spheres are **positively** charged so they repel AND symmetrical diagram. assumption that either sphere is already charged not acceptable. | [1] Correct full explanation. Conduction between the two spheres must be implied. |

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| TWO (a) | $R_T = R_1 + R_2 + R_3 = 5.6 + 3.2 + 6.2 = 15.0\ \Omega$ | [2] Correct answer. (No working required.) | | |
| (b) | $I = \dfrac{V}{R} = \dfrac{12.0}{15} = 0.80\ \text{A}$<br><br>COE possible from 2(a). | [2] Correct answer. (No working required.) | | |
| (c) | $V_{5.6\,\Omega} = 0.80 \times 5.6 = 4.48\ \text{V}\ (4.5\ \text{V})$<br><br>COE possible from 2(b). | [2] Correct working and answer. | | |
| (d) | $V_{3.2\,\Omega} = 0.80 \times 3.2 = 2.56\ \text{V}$<br>$P = VI = 2.56 \times 0.80 = 2.0\ \text{W}$<br><br>COE possible from 2(b). | [2] Correct answer for $V_{3.2\,\Omega}$ | [2] Correct working and answer. | |
| (e) | $P = VI = 12 \times 0.80 = 9.6\ \text{W}$<br>$E = P \times t = 9.6 \times 30 \times 60 = 17\,280\ \text{J}$<br>$\qquad\qquad (= 17.28\ \text{kJ})$<br><br>COE possible from 2(b). | [2] Correct answer for $P$. | [2] Correct working but fails to convert 30 min to sec and gets an answer of 288 J. | [2] Correct working and answer. |
| (f) | $I = \dfrac{P}{V} = \dfrac{36}{12} = 3.0\,\text{A}$<br><br>$R_{\text{Total}} = \dfrac{V}{I} = \dfrac{12}{3.0} = 4.0\ \Omega$<br><br>$R_{\text{each}} = \dfrac{4}{3} = 1.3\ \Omega$ | [2] Correct answer for $I$. | [2] Correct working and answer for $R$ total. | [2] Correct working and answer. |
| THREE (a) |  | [1] Correct diagram. Arrows must be very close to horizontal. | | |
| (b) | <br><br>Since the direction of the current is into the floor, the field direction is clockwise, the compass needle will point in the direction of the field, which is to the left.<br><br>OR<br><br>Explains the direction of the field using the RH grip rule. Drawing field accepted. | [1] Correct direction.<br><br>OR<br><br>reverse direction consistent with wrongly directed magnetic field.<br><br>Circular field around wire only accepted. | [1] Both direction AND explanation are correct. | |

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|---|---|---|---|---|
| (c) | $\mu_0 = \dfrac{B \times 2 \times \times d}{I} = \dfrac{6.50 \times 10^{-5} \times 2 \times \times 0.038}{12.4}$ <br><br> $= 1.25 \times 10^{-6}$ T m A$^{-1}$ | [2] Correct rearrangement of formula and data but wrong answer. | [2] Correct working and answer. <br><br> (Accept exponent form $1.25 \times 10^{-5}$.) | |
| (d) | Due to magnetic induction, both sharp ends of the nail become north poles and the heads become south poles. Since like poles repel, the heads repel each other. | [1] Mentions that the nails are magnetised so they repel. <br><br> Explanation must not refer exclusively to charges instead of poles. | [1] Mentions both sharp ends become north and heads become south and like poles repel. <br><br> Implication that they must already be magnets not accepted. | [1] Correct explanation in terms of magnetic induction. <br><br> Explanation must not refer to charges at all. |
| Four (a) | $I = \dfrac{P}{V} = \dfrac{1800}{250} = 7.2$ A | [2] Correct working and answer using 1.8 kW. <br><br> (= 0.0072 A) | [2] Correct working and answer. | |
| (b) | Voltage across the cable <br> $V_c = 7.2 \times 0.45$ <br> $\quad = 3.24$ V <br> $P = V \times I = 3.24 \times 7.2 = 23.3$ W <br> COE possible from 4(a) | | [2] Correct working for $V_c$ | [2] Correct working and answer. |
| (c) | As the smoke rises though the chimney the smoke particles rub against the positively charged wire mesh and lose electrons to become positively charged. The positively charged smoke particles are now attracted to the negatively charged inner plate of the chimney because unlike charges attract, and they stick to the inner plate. <br><br> (Description of the effect on pre-ionised negatively charged particles should be ignored.) | [1] Mentions that the smoke particles are positively charged and are attracted to the chimney's inner plate. Include pre-ionised positive particles.) | [1] Implies that the smoke particles become positively charged **when rubbed against or touch** the mesh and lose electrons, then they are attracted to the chimney's inner metal plate. <br><br> Do not accept the particles are charged by induction. | [1] Merit plus implication that unlike charges attract and this causes the positively charged smoke particles to stick to the inner plate and not rise up further up the chimney. |
| | **Total opportunities** | **Criterion 1: 9** <br> **Criterion 2: 8** | **Criterion 1: 7** <br> **Criterion 2: 6** | **Criterion 1: 3** <br> **Criterion 2: 3** |

## Judgement Statement

| Achievement | Achievement with Merit | Achievement with Excellence | |
|---|---|---|---|
| $4 \times A1$ | $3 \times M1 + 3 \times A1$ | $3 \times M1$ <br> $+$ <br> $3 \times A1$ | $+ 3 \times E$ with at least 1 from each criterion |
| $5 \times A2$ | $3 \times M2 + 3 \times A2$ | $3 \times M2$ <br> $+$ <br> $3 \times A2$ | |